Section 6: Planning

Introduction – What is planning?

Encompassing many aspects of civil design and construction, “planning” means making informed decisions based on a complete knowledge base, taking into account past and future models of development and societal trends.

In the case of a Comprehensive Plan, a “complete knowledge base” will include both objective information (maps and population/demographic data) and subjective information (public opinion surveys and responses at town meetings). Town planners and local citizens alike will find the GIS-type system both functional in terms of a communication device, and appealing in terms of a human-to-computer interface.

A Comprehensive Plan will serve two groups in the community, “leaders and residents”. It will be used as a “guiding light” for planners and town leaders to “stay the course” in their efforts to better the community and the town in which they themselves live. The Plan will offer a resource to look back upon, and a base on which many future decisions will be formed. For the “livers”, or the residents of the jurisdiction, the Plan will keep them abreast of community plans and long-term values and objectives their leaders have set for the area. It will allow them to form opinions on design trends and future zoning patterns, and most importantly, to communicate their opinions and wishes to their decision makers in an efficient and organized fashion.

Other areas of municipal management have applications in GIS as well. The zoning/rezoning process can be computerized with GIS, allowing citizens and planners alike to access zoning variance submissions and zoning ordinances. Municipal planners would be well served to have access to historical structure (and historical area) data. Historical structures cannot be cleared to make room for new development, so other provisions would have to be made. To have this data incorporated into a GIS would be a large help to the planning process.

Transportation planning and maintenance is an industry of its own, but this data, too, can be integrated into a GIS; it can be either *Inter-* or *intra*net based. Planning for construction of a road or other transportation system requires a vast amount of spatial data, including existing roads, topography (contour lines), hydrology (creeks and rivers), existing tax parcels, and existing structure footprints. Other data (like drainage features and zoning maps) may prove to be extremely helpful in the process of planning a new road alignment. All this data can be hosted and served by a GIS; this centralizes all data, making the process of data access extremely efficient.

A) Development & Maintenance of a Comprehensive Plan

1) Spatial Data
   a) Minimum Requirements
      - Road maps of the jurisdiction area
      - Tax parcel mapping
      - Zoning data
      - Current land use
      - Future land use (projected)
      - Buildings and structures
   b) Optional Requirements
      - Digital orthophotography
      - Point data
        - ⇒ School locations
        - ⇒ Healthcare locations
        - ⇒ Childcare locations
        - ⇒ Religious structures
        - ⇒ Recreation locations
        - ⇒ Historic landmarks
        - ⇒ Flora (trees, shrubs, bushes)
      - Line maps
        - ⇒ Sidewalks
        - ⇒ Greenways
        - ⇒ Bike routes
        - ⇒ Water lines
        - ⇒ Sewer lines
        - ⇒ Power lines
        - ⇒ Telephone lines
        - ⇒ Television cable lines
      - Polygon Data
        - ⇒ Municipal district overlays
          - (i) Police
          - (ii) Fire
          - (iii) Rescue
          - (iv) School
          - (v) Voting
          - (vi) Refuse collection
        - ⇒ Parks
        - ⇒ Recreation facilities
        - ⇒ Neighborhoods
        - ⇒ Historic districts
      - Note: to have an effective Comprehensive Plan, as many of these data should be included whenever and wherever possible.

2) Attribute Data
   a) Road maps
      - Minimum Requirements
        - ⇒ Road type (private or public)
        - ⇒ Route number or road name (whichever is applicable)
      - Optional Requirements
        - ⇒ Speed limit
        - ⇒ Heading (NW/SE, N/S, E, etc.)
        - ⇒ Directions of travel (one or two)
        - ⇒ Construction material

- ⇒ Length of segment
- ⇒ Year built
- ⇒ Year last paved
- ⇒ Number of cars/minute (average)

b) Zoning maps
- Minimum Requirements
  - ⇒ Zone type/designation
- Optional Requirements
  - ⇒ Number of parcels included
  - ⇒ Variances
  - ⇒ Date last zoned
  - ⇒ Age of structure(s)

c) Tax Parcel Maps
- Minimum Requirements
  - ⇒ Unique parcel identifier (tax map number, GPIN, etc.)
  - ⇒ Zone type
- Optional Requirements (real estate database information)
  - ⇒ Owner name
  - ⇒ Owner address
  - ⇒ Property address
  - ⇒ Deed Book/Page
  - ⇒ Plat Book/Page
  - ⇒ Land value
  - ⇒ Structure value
  - ⇒ Total value
  - ⇒ Age of structure(s)
  - ⇒ Acreage
  - ⇒ Date last assessed
  - ⇒ Date last surveyed

d) Point Data
- Minimum Requirements
  - ⇒ Name of point
  - ⇒ Type of point (school, church, etc.)
- Optional Requirements (real estate database information)
  - ⇒ Owner name
  - ⇒ Owner address
  - ⇒ Property address
  - ⇒ Deed Book/Page
  - ⇒ Plat Book/Page
  - ⇒ Land value
  - ⇒ Structure value
  - ⇒ Total value
  - ⇒ Age of structure(s)
  - ⇒ Acreage
  - ⇒ Date last assessed
  - ⇒ Date last surveyed

e) Line Maps
- Minimum Requirements
  - ⇒ Name of line
  - ⇒ Type of line (sidewalk, water line, etc.)
- Optional Requirements
  - ⇒ Owner name
  - ⇒ Owner address

- ⇒ Ownership (private or public)
- ⇒ Length of line
- ⇒ Width of line
- ⇒ Material of line (PVC, cement, etc.)
- ⇒ Date built/installed
- ⇒ Date of last inspection

f) Municipal District Overlays

- Minimum Requirements
  - ⇒ District name
  - ⇒ District type (police, fire, etc.)
- Optional Requirements
  - ⇒ Population served
  - ⇒ Maximum population capacity

3) Data Acquisition Options

a) Road mapping

- Acquire from Virginia Department of Transportation (limited availability) or from a third party vendor

b) Zone mapping

- Planning department
- Hardcopy tax maps

c) Orthophotography sources

- VGIN's VBMP imagery
- USGS orthophotography (DOQs)
- Aerial photography from a third party vendor

d) Tax mapping

- In-house
  - ⇒ Scan hardcopy tax maps and geo-reference them, according to the coordinate system chosen
  - ⇒ On-screen (heads-up) digitization of parcel boundaries relative to tax maps
    - (i) Quick, but less accurate than using Coordinate Geometry (CoGo)
  - ⇒ Entering each parcel boundary into CAD/GIS software using deed books and property descriptions
    - (i) Extremely accurate, but time-consuming and expensive
  - ⇒ More information can be found in the Finance/Tax Mapping section
- Contract with third party vendor for digitization work

e) Real estate database

- Acquire from Clerk's or Commissioner of Revenue's Office
- Convert ASCII text or spreadsheet into Microsoft Access format for ease of use

4) Data Conflation Options

a) Orthophotography

- Verify that all digital orthophotography image chips to cover the county or interest area are accessible (if applicable).
- Use CAD/GIS software to mosaic all image chips into one complete image, for ease of use.

b) Tax Parcel Mapping

- Conflate the tax parcel boundary data to the orthophotography, using the imagery as a reference rather than as a determiner of absolute property location. A real estate database can be used to check property addresses against existing E-911 street address mapping.
- Maintain relative parcel size, geometry, and orientation within a section map.

c) Zone Mapping

- Conflate zone mapping to the orthophotography and the tax mapping, again, using the imagery as a reference rather than as a determiner of absolute zone location.

d) Point/Line Data

- Manually conflate the point and/or line data to the digital orthophotography, including school locations, hospital locations, etc.

5) GUI/Programming Options
   a) Access to all Comprehensive Plan pages, images, figures, and appendices through a custom online interface tailored to the community's values and personality.
   b) Citizens should be able to remotely (via Internet) access public surveys/questionnaires and have the ability to respond to them from the comfort from their homes.
   c) An online public forum should be available for residents and business owners alike to help form and shape the plan's immediate and future action plans.
   d) Action plan progress should be updated regularly so residents can see the Plan's immediate influence on them and on their neighborhoods and community.
6) Internet Functionality and Options
   a) From an Internet standpoint, all mapping information (both required and optional, if applicable) should be integrated into one GIS-type interface similar to the Town of Blacksburg's online Comprehensive Plan, available at http://www.blacksburg.va.us/comp_plan/.
   b) All GUI/Programming Options listed above should be made available online so the citizens of your jurisdiction can access and view them.
7) Technical Requirements
   a) Minimum Requirements
      - 400-MHz
      - 2-GB hard drive
      - 256-MB RAM
      - 15" monitor
      - CAD/GIS software
      - Scanner (if electing to digitize in-house)
      - Internet connection (for downloading data, if applicable)
   b) Optional Requirements
      - A faster machine will make work quicker; listed above is absolute minimum
      - 850-MHz or above recommended
      - 20-GB hard drive for increased storage space
      - 512-MB RAM for faster regeneration and manipulation of data
      - 17" or 19" monitor for increased screen resolution (and larger viewing area)
8) Administrative/Management Requirements
   a) During development
      - Public meetings
      - Public opinion surveys
      - Complete inventory of all the variables that make up the situation
      - Plan development
      - Plan acceptance
   b) After deployment
      - Scheduled reviews/revisions
      - Implementation
      - Made available online or hardcopy
9) Cost – Cost/Benefit
   a) In-house
      - GIS technician - $8-$14 per hour
      - Project manager - $16-$20 per hour
      - Note: in-house costs do not include benefits and overhead
   b) Contracted
      - GIS technician - $30-$50 per hour
      - Project manager - $55-$70 per hour
   c) Schedule:
      - Tax maps need to be converted to digital:
        ⇒ Using the following items from the Schedule section, we can estimate a cost per tax map sheet for digital work.

(i) Scanning (10 minutes per sheet)
(ii) Digitization (3 hours per sheet)
(iii) Annotation (1 hours per sheet)
(iv) Conflation (8 hours per sheet)
(v) Edge-matching (1 hour per sheet)
(vi) Total time per sheet is *about* 13-14 hours.

⇒ A typical Virginia county is comprised of about 100 tax map sheets. Larger counties will include more; small counties will include fewer.

⇒ Therefore, an average county will require about 1300-1400 hours to complete the digital parcel mapping tasks listed above, or about $10,000 to $20,000 if done in-house.

⇒ These are average estimates; time for any given tax map (or even an entire jurisdiction) will vary greatly. Use the scale bar on each of your tax maps to determine how many encompass the area you desire.

⇒ Zoning and other maps should be created during the tax map digitization process; completing all data at one time is more efficient than creating each map or dataset separately.

- Tax maps are already in digital form:
  - ⇒ Other forms of map data (point items, line items, etc.) should be manually conflated to tax parcel maps and/or digital orthophotography images as applicable.
  - ⇒ Costs for this work will vary widely with number of items to conflate, the size of the jurisdiction, etc.

d) Benefits of a GIS
- A GIS provides a powerful, logical, and intuitive means to store, manipulate, and retrieve data.
- It can maintain, analyze, and report on geographic data such as points and symbols, lines and curves or polygons, and attribute data such as characters, numbers, and dates.
- A GIS provides the ability to see on screen or in map form, only those features or objects that meet specific selection criteria.
- In an instant, you can visually identify features in a geographic representation that would take much longer to find (and modify if needed) in a printed report.

10) Standards/Guidelines Summary

a) Spatial data
- A standard data projection of State Plane Coordinates (which are in feet) using NAD83 as the datum.
- Geographic data you want to see, such as road maps, zoning maps, land use maps, tax parcel maps, buildings and structures, etc.

b) Attribute data
- Database information behind the visual data. Includes real estate database information, linked to tax and zoning maps and other attribute data for other forms of spatial data.

c) Data acquisition
- Where and who you will get your data from.
- Most data is available from other governmental or municipal agencies, like Commissioner of Revenue's Office, Virginia Department of Transportation, etc.

d) Data conflation options
- Geometrically match your new data to your existing data.
- When a best match isn't obvious, look for existing tree lines in the underlying photography. These, as well as other natural or man-made, features can provide a great insight and offer another solution as to how the data should line up.
- Establish a "base map" for your system (digital orthophotography for example) and correct all other maps to coincide with the aerial photos.

e) GUI/programming options
- How you can work with your data; includes custom database interfaces, possible Internet interfaces, review/revision provisions, etc.

f) Internet functionality options
- How you can put your data on the Internet (and its uses thereafter).
- Examine current examples on the Internet.

- Conduct public opinion surveys to discover what your citizens would like to see in your online system.
- Items listed here are merely examples.

g) Technical requirements
- What you will need to acquire, manipulate, and store your data.
- Listed here are absolute minimums. Faster machines will increase efficiency.
- In this case, "the faster the better."

h) Administrative requirements
- Administration processes before and after system deployment. Listed (but not limited to) are tasks involved with setting up your system; includes working with other agencies, working with the public, advertising your system, and other tasks.

11) Startup Procedures/Steps

a) Digitization
- On-screen (heads-up) digitization:
  - ⇒ Scan each hardcopy map.
  - ⇒ Digitize all boundary lines in CAD/GIS software, including all historical and archaeological site boundaries and limits.
- If Coordinate Geometry (CoGo) information is available for a site or area:
  - ⇒ Enter boundary lines into CAD/GIS software using Coordinate Geometry (CoGo) and property descriptions.

b) Annotation
- Using hardcopy maps or other information source, annotate all areas with the attributes desired (name, type of region, etc.).
- Keep text insertion points in the centers of polygons, for ease of reading and for ease of database creation and linking after the data is ready.

c) Conflation
- Verify that all digital orthophotography image chips to cover the county or interest area are accessible.
- Use CAD/GIS software to mosaic all image chips into one complete image, for ease of use.
- Conflate the region boundary lines to the orthophotography, using the imagery as a reference for location of boundary lines of each area or region.
- Maintain relative size, geometry, and orientation of said area when conflating to orthophotography.

d) Edge-matching (if multiple tax maps are involved)
- Parcels or regions that encompass multiple tax map sections must share agreeable boundaries.
- A parcel or area boundary has given metes & bounds; this information should agree for a boundary line that splits tax map sections.
- Even if the boundary was conflated, and not entered with CoGo information, boundary lines that cross tax map section lines must still run along the same heading and cross the tax map boundary in the same place on both tax maps.
- Single parcels or regions separated by tax map boundaries should contain one (and only one) unique identifier.

12) Estimated Time Line and/or Implementation Schedule

a) If tax maps need to be converted to digital:
- Scanning (10 minutes) per sheet
- Digitization (3 hours) per sheet
- Annotation (1 hours) per sheet
- Conflation (8 hours) per sheet
- Edge-matching (1 hour) per sheet
- Approximately 13 to 14 man-hours are needed to accomplish the above tasks for each tax map. This is based on a moderately populated area. Variations in population density can shorten or lengthen the time needed to complete all data for a single tax map.

b) If tax maps are already digital:
- Other forms of map data (point items, line items, etc.) should be manually conflated to tax parcel maps and/or digital orthophotography images as applicable.

- Time estimates for this work will vary widely with number of items to conflate, the size of the jurisdiction, etc.

13) Best Practice Examples in Virginia
   a) The Town of Blacksburg has one of the first online interactive Comprehensive Plans and it is available to citizens and interested visitors 24 hours a day via the Internet at http://www.blacksburg.va.us/comp_plan/.
   b) There are now Master Plans and Comprehensive Plans available on the Internet for communities around the world. The advantages of digital information far outweigh the time and energy dedicated to making it available to the public.